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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/720,430	11/24/2003	Cedric Carlton Lowe	137264	5103

7590 03/13/2006

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EXAMINER	
VERDIER, CHRISTOPHER M	
ART UNIT	**PAPER NUMBER**
3745	

DATE MAILED: 03/13/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/720,430	LOWE ET AL.	
	Examiner	Art Unit	
	Christopher Verdier	3745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 December 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-35* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6, 10-17, 20, 23-29* is/are rejected.

7)☒ Claim(s) *7-9,18,19,21,22 and 30-35* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 November 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Applicants' amendment dated December 20, 2005 has been carefully considered but is non-persuasive. Claims 1-35 are pending. The specification has been amended to correct the informalities set forth in the first Office action. Applicant has stated that the specification has been amended to overcome the objection thereto as failing to provide proper antecedent basis for the claimed subject matter. Actually, claims 16, 20, 28, and 34 were amended in order to overcome the objection to the specification as failing to provide proper antecedent basis for the claimed subject matter. At any rate, the objection to the specification as failing to provide proper antecedent basis for the claimed subject matter has been overcome by the amendment to claims 16, 20, 28, and 34. Applicant has amended the claims in accordance with the suggested claim language to improve the clarity and precision of the claims. Claim 20 has been amended to overcome the rejection under 35 USC 112, second paragraph as being inaccurate, as set forth in the first Office action. Correction of these matters is noted with appreciation.

Applicant has argued concerning the rejection of claims 1-6 and 10-17 under 35 U.S.C. 102(b) as being anticipated by Lee 6,155,778, and also concerning the rejection of claims 20 and 23-29 under 35 U.S.C. 103(a) as being unpatentable over Lee 6,155,778 in view of Proctor 5,169,287, that Lee does not disclose an asymmetric portion B of the cooling apertures having an asymmetrical density of aperture inlets that is asymmetric with respect to the axially extending midline. Applicant has specifically argued that it is clear from observing the cooling apertures in Lee that in any given panel all of the cooling holes are equally spaced apart in any given row that crosses line 12 and that thus there is no asymmetrical density of aperture inlets that is asymmetric with respect to the axially extending midline. Applicant has further argued

that all of the densities of holes with respect to the midline 12 are symmetric, and that while there may not be the same number of holes on the two sides of midline 12, they are still all spaced equally apart and therefore the density of holes on either side of the midline 12 is the same and is symmetrical across the midline, and not asymmetrical across the midline, and that Lee does not disclose any high density areas of the cooling apertures. The examiner respectfully disagrees with these arguments. The asymmetrical portion B of cooling apertures 64 indicated in the annotated figure of Lee below has an asymmetrical density of aperture inlets that is asymmetrical with respect to the axially extending midline 12, because portion E is a low density area, having three cooling apertures in a single column that extends perpendicular to midline 12, adjacent to aft end 56, while portion C is a high density area, having four cooling apertures in a single column that extends perpendicular to midline 12, adjacent to aft end 56. It is clear from figure 4 that the number of cooling apertures in the single column portion E, divided by the distance from the midline to the top of the shroud segment, is less than the number of cooling apertures in the single column portion C, divided by the distance from the midline to the bottom of the shroud segment. Therefore, portion E is considered to be a low density area, and portion C is considered to be a high density area.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-6 and 10-17 are rejected under 35 U.S.C. 102(b) as being anticipated by Lee 6,155,778 (figures 1-2 and 4). See the annotated figure at the end of this paragraph. Lee discloses a turbine shroud assembly cooling element 40 comprising an arcuate panel 48 circumscribed about an axis of rotation 12 and having opposite axially spaced apart forward and aft ends 54, 56, a plurality of cooling apertures 64 extending through the panel, an axially extending midline 12 of the panel parallel to the axis of rotation, a symmetric portion A of the cooling apertures having a symmetrical density of aperture inlets that is symmetric with respect to the axially extending midline, and an asymmetric portion B of the cooling apertures having an asymmetrical density of aperture inlets that is asymmetric with respect to the axially extending midline. There is a high density area C of the cooling apertures in the asymmetric portion of the cooling apertures with the high density area having a higher density of aperture inlets than in the symmetric portion of the cooling apertures, and a low density area E of the cooling apertures in the asymmetric portion of the cooling apertures with the low density area having a lower density of aperture inlets than in the symmetric portion of the cooling apertures. (Note that in high density area C of figure 4, there are four cooling apertures 64 adjacent to aft end 56, while in low density area E of figure 4, there are three cooling apertures 64 adjacent to aft end 56). The high density area is located in a wake region of the arcuate panel, because upstream stator vanes 24 cause a wake of the working fluids flow across the entire panel. The cooling element is a shroud segment and the arcuate panel is a base, and the cooling apertures are convection cooling apertures. The high density area of the convection cooling apertures is located in the wake region as above. An unnumbered first portion of the convection cooling apertures are axially

angled forwardly with respect to the axis of rotation (see figure 2), and an unnumbered second portion of the convection cooling apertures are axially angled rearwardly with respect to the axis of rotation (see figure 2).

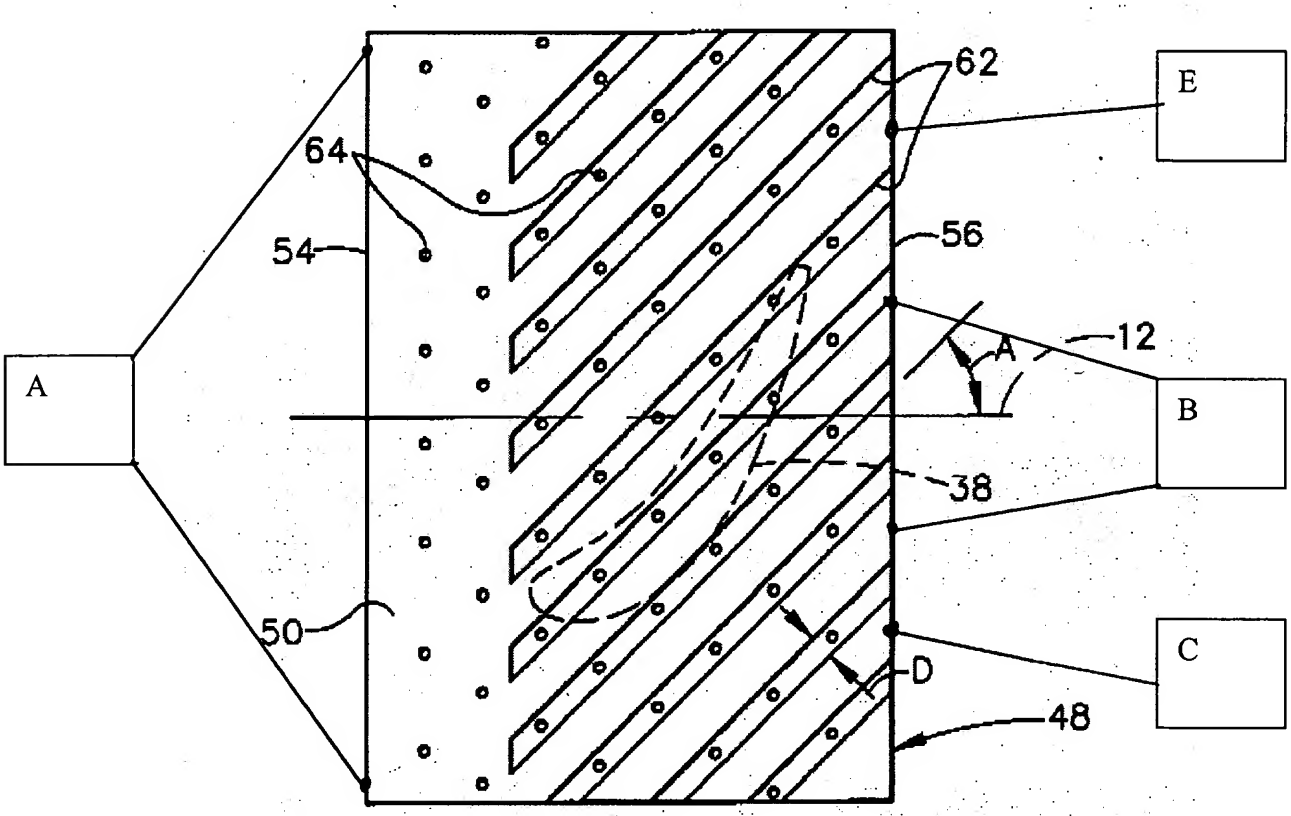

FIG. 4

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 20 and 23-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee 6,155,778 in view of Proctor 5,169,287. Lee (figures 1-2 and 4, referring to the annotated figure above) discloses a turbine shroud assembly 40 substantially as claimed, comprising a plurality of arcuate shroud segments 48 circumferentially disposed about an engine centerline axis 12, each of the shroud segments including a base having a radially outer back surface, a radially inner front surface, and opposite axially spaced apart upstream and downstream ends 54, 56, a plurality of angled elongated convection cooling apertures 64 extending through the base with convection aperture inlets at the back surface and aperture outlets at the radially inner front

surface, an arcuate hanger 42 supporting the shroud segments and secured to a gas turbine engine outer casing 44, an unnumbered shroud chamber radially disposed between the hanger and bases, an unnumbered metering hole disposed through the hanger, the midline of the base being parallel to the engine centerline axis, and asymmetric portions B of the cooling apertures having asymmetrical densities of aperture inlets that are asymmetric with respect to the axially extending midline. There is a high density area C of the convection cooling apertures in the asymmetric portion of the cooling apertures with the high density area having a higher density of aperture inlets than in a symmetric portion A of the convection cooling apertures, and a low density area E of the convection cooling apertures in the asymmetric portion of the convection cooling apertures with the low density area having a lower density of aperture inlets than in the symmetric portion of the convection cooling apertures. (Note that in high density area C of figure 4, there are four cooling apertures 64 adjacent to aft end 56, while in low density area E of figure 4, there are three cooling apertures 64 adjacent to aft end 56). The high density area is located in a wake region of the arcuate panel, because upstream stator vanes 24 cause a wake of the working fluids flow across the entire panel. The cooling element is a shroud segment and the arcuate panel is a base, and the cooling apertures are convection cooling apertures. The high density area of the convection cooling apertures is located in the wake region as above. An unnumbered first portion of the convection cooling apertures are axially angled forwardly with respect to the axis of rotation (see figure 2), and an unnumbered second portion of the convection cooling apertures are axially angled downstream (see figure 2).

However, Lee does not disclose that hanger 42 is segmented, and does not disclose a pan-shaped baffle radially disposed in the shroud chamber between each of the hanger segments and bases and defining a baffle plenum in the shroud chamber and radially outwardly of the baffle, with a metering hole through each of the hanger segments and leading to the baffle plenum, with a plurality of impingement apertures having impingement aperture inlets through a panel of the baffle and generally oriented towards the base, the panel being radially spaced apart from and generally concentric with the base, and does not disclose parallel axially extending midlines of the panel and the base, with the midline of the panel being parallel to the engine centerline axis

Proctor '287 (figure 1) shows a turbine shroud assembly having a hanger 24 that is segmented, with a pan-shaped baffle 68 radially disposed in an unnumbered shroud chamber between each of the hanger segments and bases 44 of shroud segments 22 and defining a baffle plenum 72 in the shroud chamber and radially outwardly of the baffle, with a metering hole 76 through each of the hanger segments and leading to the baffle plenum, with a plurality of impingement apertures 78, 78a having impingement aperture inlets through a panel of the baffle and generally oriented towards the base, the panel being radially spaced apart from and generally concentric with the base, with parallel axially extending midlines of the panel and the base, with the midline of the panel being parallel to the engine centerline axis, for the purposes of accommodating for thermal expansion and contraction of the hanger segments, and providing impingement cooling to the shroud segments.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to form the turbine shroud assembly of Lee such that hanger 42 is segmented, and to provide a pan-shaped baffle radially disposed in the shroud chamber between each of the hanger segments and bases and defining a baffle plenum in the shroud chamber and radially outwardly of the baffle, with a metering hole through each of the hanger segments and leading to the baffle plenum, with a plurality of impingement apertures having impingement aperture inlets through a panel of the baffle and generally oriented towards the base, the panel being radially spaced apart from and generally concentric with the base, with parallel axially extending midlines of the panel and the base, with the midline of the panel being parallel to the engine centerline axis, as taught by Proctor, for the purposes of accommodating for thermal expansion and contraction of the hanger segments, and providing impingement cooling to the shroud segments.

Allowable Subject Matter

Claims 7-9, 18-19, 21-22, and 30-35 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christopher Verdier whose telephone number is (571) 272-4824. The examiner can normally be reached on Monday-Friday from 10:00-6:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward K. Look can be reached on (571) 272-4820. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

C.V.
March 2, 2006

Christopher Verdier
Primary Examiner
Art Unit 3745